

Claims

1. An electrode for contacting an electrically conductive surface, in particular for contacting at least one surface of a photovoltaic element (wafer 3), the electrode comprising an electrically insulating optically transparent film (10), an adhesive layer (11) provided on one surface of said film (10), and a first plurality of substantially parallel, electrically conductive wires (5') being embedded into the adhesive layer (11), a part of the surfaces of said wires (5') protruding from the adhesive layer (11) and at least on the surface protruding from the adhesive layer (11) being covered by a coating (2) consisting of an alloy with a low melting point, wherein the wires (5') of the first plurality are electrically connected to a first terminal bar (20).
2. Electrode according to claim 1, wherein a second plurality of wires (5'') substantially running parallel to each other is disposed between the transparent film (10) and the wires (5') of said first plurality, the wires (5', 5'') of the first and second pluralities forming together a mesh (6), and the wires (5'') of the second plurality being electrically connected to a second terminal bar (22).
3. Electrode according to claim 2, wherein the first and second terminal bars (20, 22) are electrically connected to each other.
4. Electrode according to any of the preceding claims, wherein the terminal bar(s) (20, 22) are provided at the respective ends of the wires (5', 5'').
5. Electrode according to claim 4, wherein the terminal bar(s) (20, 22) are provided at opposite ends of the wires of the first or of the first and second pluralities of wires (5', 5'') outside the contour of the photovoltaic element (wafer 3), to the surface of which the wires (5', 5'') are to be connected.
6. Electrode according to any of claims 1 to 5, wherein the first and second terminal bars (20, 22) are connected to form an angle (Fig. 8).
7. Electrode according to any of claims 1 to 5, wherein the terminal bars (20, 22) are formed as a U-formed frame, the wires of one of the two pluralities (5') being connected to the

base and the wires of the other plurality (5") being connected to the free legs of the U (Fig. 13).

8. Electrode according to claim 5, characterized in that the terminal bars (32) are extending over the length of two adjacent photovoltaic elements (3) to be connected and that a step is provided in their centre, so that a plurality of terminal bars (32) can be fit together forming one row, in which the one half of a terminal bar (32) is arranged below or above the lower or upper halves, respectively, of the neighbouring terminal bar (32), wherein between the terminal bars (32) an insulating film (19) (Fig. 16) is provided.

9. Electrode according to claim 5, wherein the terminal bars are formed as a closed frame (17), the open area (window) of said frame (17) exceeding the dimensions of the corresponding photovoltaic element (3) (Fig. 9).

10. Electrode according to claim 5, wherein the terminal bar(s) is (are) formed as a double frame (17) with two adjacent windows, the open area of which exceeds the dimensions of the corresponding photovoltaic elements (3).

11. Electrode according to claims 9 or 10, wherein the frame (17) comprises two metallic frames (18) with an insulating film (19) provided between them.

12. Electrode according to claim 10 or 11, wherein a step is provided in the central bar of the double frame (17), so that a plurality of frames (17) can be fit together forming one row, in which the one half of a double frame (17) is arranged below or above the lower or upper halves, respectively, of the neighbouring double frame (17).

13. Electrode according to claim 11 or 12, wherein a slot (33) is provided in the central bar of the double frame (28), said slot running parallel to said step, so that upon completion of a PV module the traversing wires (5') of the electrode (16) can be cut.

14. Electrode according to any of claims 9 to 13, wherein metallic bars (31) are spanning over at least one window of the frame(s), said bars (31) being integrally connected with the corresponding metallic frame (18).

15. A plurality of electrodes according to any of the preceding claims, wherein the electrodes are formed as an endless, continuous strip, which can be cut to a length corresponding to the length of an array of adjacent photovoltaic elements (3) to be connected for forming a PV module, wherein the wires (5') running in longitudinal direction of the strip are cut at distances corresponding to the distances of the PV cells (Fig. 14).

16. Electrode strip according to claim 15, wherein an endless terminal bar (22) is provided along at least one of the edges of the transparent film (10).

17. Electrode strip according to claim 16, wherein along each edge of the transparent film (10) are arranged comb-like terminal bars (23), the teeth (25) of which reaching respectively from one side between two adjacent photovoltaic elements (3) over the width of the wires (5') of the first plurality and alternately being in electrical contact with the upper and lower sides of corresponding photovoltaic elements (3) and being isolated from the other surface.

18. A PV cell or a PV module comprising at least one electrode (16) or one electrode strip (16) according to any of the preceding claims, comprising one or more photovoltaic cells (3) with an electrically conductive, antireflective, optically transparent coating (4) on at least one of its surfaces, the wires (5') of the first plurality being soldered onto the coating (4) and onto the respective terminal bars (20) or terminal frames (17) by means of the alloy (2).

19. A PV cell or a PV module according to claim 18 comprising an electrode (16) according to claim 2, wherein the wires (5', 5'') of the first and second pluralities are bonded together at their crossing points and onto the respective terminal bars or terminal frames by means of the alloy (2).